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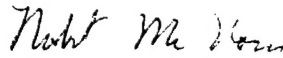
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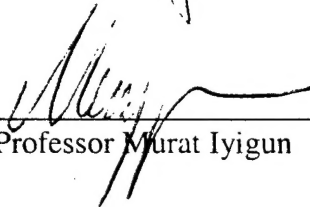
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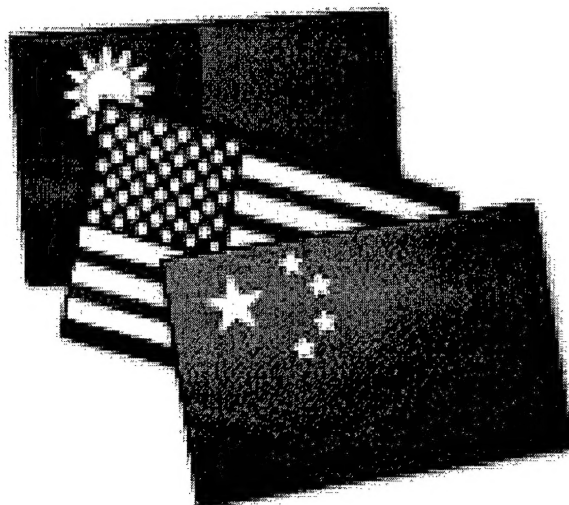B.S., United States Air Force Academy, 2001

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Political Shocks and Abnormal Returns During the Taiwan Crisis:

An Event Study Analysis

Thesis directed by Professor Robert McNown

The size and significance of a political shock's impact on financial markets is seldom fully understood. Often the effects of a shock are underestimated, affecting markets more significantly than expected. Likewise, these event's impacts can be overestimated, a phenomenon perhaps perpetuated by the media, which may cause people to view a political shock as more severe than it might be otherwise. Focusing on the 1996 Taiwan Crisis, by means of event study analysis, this paper attempts to determine the extent to which this political shock affected the Taiwanese, and surrounding Japanese stock markets.

Using standard OLS and GARCH modeling techniques, this paper finds little support that the Taiwan Crisis strongly affected the Taiwanese markets, or caused contagion effects in Japanese markets. This result is contrary to the media's portrayal that the Taiwan Crisis caused abnormal returns and excess volatility in the regions examined.

The results have economic and political implications. One implication brings to question the validity of the media's assertion that this conflict disrupted financial markets. Another implication suggests that citizens in the region trust the safeguards in place to prevent conflict. Furthermore, the modeling and methodology used in this paper could be applied to examine how political shocks may affect other financial markets.

I. INTRODUCTION AND MOTIVATION

> "News of the missile exercises caused Taipei stock prices to fall as
> nervous investors began selling, and gold dealers said hoarding
> might begin. Taiwanese residents living near the China mainland
> began stocking up on food in case the exercises escalate into
> conflict." (CNN World News, 1996b)

Early in the morning of March 5, 1996, mainland China announced live fire military exercises in the Strait of Taiwan to intimidate Taiwan before its first democratic presidential elections. The following day the Taiwanese stock market dropped by 62 points. The world, particularly the Asian region, watched nervously wondering whether Taiwan and China soon might become embroiled in military conflict. Given the high levels of investment and significant trade links into the China/Taiwan region, perhaps the Crisis caused negative spillover effects for the Asian region. Japan, a heavy supplier of foreign direct investment to the region and substantial trade partner, perhaps had the largest vested interest in maintaining regional stability, as conflict in Taiwan could spoil Japanese investments in the region.

It seems plausible that an exogenous political shock, such as the Taiwan Crisis, could affect economies. But to what degree do these events propagate through markets? Given the tremendous media coverage surrounding these events, one may conclude that these exogenous shocks significantly reduced economic growth. Shortly after the announcement of live fire exercises, the media reported bank runs, gold hoarding, and food stockpiling (CNN World News, 1996a). Other news sources cited a depressed level of investor confidence that would induce further

capital flight from the region, and cause shipping insurance premiums to skyrocket (Fischer and Yates, 1996b). A chief Chinese economist from the China Trust Bank explained on March 11, "Through waves of more and more menacing military moves, China is demonstrating its ability to influence Taiwan's financial markets and the overall economy" (Associated Press, 1996). Thus, according to different news publications, it seems that Chinese intimidation significantly and adversely affected Taiwan's markets.

But to what extent can we be certain the media is correct and China's "menacing" significantly impacted Taiwanese financial markets? In response to a Taiwan Crisis question in a March 19, 1996 Department of Defense news briefing, Public Affairs Official Kenneth Bacon, from the Office of the Assistant Secretary of Defense replied:

> We've (the United States) said that we would take any attack on Taiwan very, very, seriously. We don't expect that there will be an attack. We do not expect military action here. The war fever that appears to be evident in the press is not shared in Taiwan. It's not shared in the United States government, nor is it shared in the Chinese government. From all public statements, everybody expects that there will be a peaceful resolution. (see DoD newsbrief [1996] for full discussion)

From the standpoint of the U.S. government, it seems plausible the media artificially created a "war fever" in the Strait of Taiwan, that never seemed to have credibility amongst the major international actors. Therefore, others may view the shocks associated with the Taiwan Crisis as having limited economic effects, and disregard the media hype surrounding the event. Some explanations for why markets may not be affected suggest that markets are too robust to be significantly influenced by an event such as the Taiwan Crisis. Another reason why markets may not react to

Chinese militarization is that the markets already have discounted the credibility of Chinese militarization due to prior intimidation tactics. In a sense, the markets may have called China's military bluff. Still others may assert that Asian markets, particularly Taiwan, are consistently volatile, and that the markets at the time of the Crisis were no more volatile than normal.

This study aims to untangle the arguments presented above by empirically testing for abnormal market returns and unusual volatility after the onset of a political shock in the Taiwanese and Japanese economies. To achieve this end the paper builds upon established theories within economic and political economy literature. First, it builds upon the political economy and growth literatures that suggest political stability is paramount for economies to flourish. Empirically it has been shown that political shocks such as coups, assassinations, military actions, and wars negatively affect economies. Furthermore, certain studies suggest domestic political instability causes contagion resulting in negative spillover effects to neighboring economies. Second, this research borrows from the financial economics literature, which attempts to explain how financial markets behave. One of the prominent theories used in this research empirically shows that international markets are dependent on each other. This paper builds on this dependency concept to explain how political shocks may propagate to other markets. Additionally, market interconnectedness and contagion phenomena explain some of the variation in stock returns. Finally, this research borrows from financial economics which asserts to some degree markets are efficient and react to new information in a timely fashion.

II. OBJECTIVES

The overarching objective of this paper is to determine the extent that the Taiwan Crisis propagated through markets to cause abnormal returns or volatility in Japan or Taiwan. But before explaining how shocks affect financial variables, it is necessary to have a working understanding of what defines an exogenous shock. An exogenous shock is defined as an unanticipated event or disturbance. Examples include acts of nature, terrorist activities, coups, assassinations, revolutions, civil unrest, and other major unforeseeable events that could not already be discounted by the markets. Other economic shocks are ill-suited to explain market variance, as they likely fall victim to the pitfall of endogeneity. These endogenous shocks include interest rate cuts, outcomes of predictable elections, or other relatively anticlimactic events to which markets have already have reacted. It also should be noted that exogenous shocks to an economy could be permanent or temporary in nature. Permanent shocks typically stem from events of great magnitude and continue to affect economies indefinitely. In contrast, temporary shocks are usually a result of resolvable political events, and thus affect economies for shorter time periods.

The study's next objective is developing a proxy to predict economic performance by establishing a pattern for normal stock returns. Lin, Engle, and Ito (1994) suggest returns and volatility within the Japanese and U.S. markets are related. Thus, this cross-border stock market correlation can be used to establish a trend of normal returns for the Japanese markets. MacKinlay (1997), Calvo-Gonzalez (2002), and Gilchrist (1998) all incorporate similar models that use market

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returns as a proxy for industry returns. This paper will build upon the work of these authors to establish a pattern of normal returns by introducing dummy variables at the onset of the Taiwan Crisis to test for abnormal returns. After running the model and obtaining results, the paper will interpret the results to gauge the impact of the Taiwan Crisis on the Japanese and Taiwanese economies vis-à-vis stock market analysis. In conclusion, the paper will address the results and speculate at policy implications.

III. HISTORICAL OVERVIEW

It is necessary to have a working knowledge of Taiwan and China's post-1949 history to understand the nature of the Taiwan Crisis, and the extent to which markets interpret the region's political and military finagling. The basis for conflict is a legitimacy issue. Essentially, in 1949 nationalist leader Chiang Kai-shek moved the seat of his defeated government to Taiwan. Likewise, Mao Zedong, leader of communist movement, controlled mainland China, or today's People's Republic of China (PRC). Both leaders maintained that their governments were legitimate, and sought unify and control both Taiwan and the mainland. Chiang sought to recapture the mainland for the ROC, while the PRC sought (and continues to seek) to retake the "renegade province" of Taiwan (Campbell and Mitchell, 2001). This fundamental issue of legitimacy has perpetuated conflict since 1949, and continues to manifest itself today.

The Taiwan Crisis examined in this paper is actually the third recognized Taiwan Crisis amidst a volatile post-1949 history. The first Taiwan Crisis occurred in 1954, over the control of two strategic coastal islands, Quemoy and Matsu. The

second Taiwan Crisis happened in 1958 over control of the same islands. The next four decades were marked by smaller scale skirmishes, as conflict and Chinese intimidation of Taiwan became the status quo. China, in hopes of regaining Taiwan, continually asserted its right to take Taiwan by force should Taiwan declare independence. In 1979 the United States recognized Beijing as the legitimate government of China. However, in the same year the United States softened its support for the PRC by signing the Taiwan Relations Act, which guaranteed Taiwan's safety should China attack. In July 1995, just months prior to the Taiwan Crisis examined in this research, China began a series of missile tests only 60 kilometers off the coast of Taiwan.

Certainly, China's continual intimidation of Taiwan has been priced into the stock markets. Taiwan and Japan's financial markets must have conditioned themselves to the potential for conflict between Taiwan and China, and to some extent viewed China's threats with little credibility. But is it possible that the 1996 Taiwan Crisis represented a more viable and risky threat than was already discounted by the markets? Did this PRC action cause any additional market disturbance not already priced in by the markets? The point of this research is to determine whether markets viewed China's military actions in March 1996 as "excess conflict" which resulted in abnormal market returns or volatility, or if the markets viewed China's threats as standard behavior.

IV. LITERATURE REVIEW

This paper borrows heavily from the political economy and financial market literatures. The different theories contributions to this research will be discussed in the subsequent sections.

Political Economy Literature

A significant body of literature suggests that politically destabilizing events adversely affect economic performance. In a cross sectional study of 98 nations, Barro (1991), found domestic political instability, and thus exogenous political shocks, to negatively affect growth and investment. Barro developed two political instability indexes; the first measuring the number of revolutions and coups per year and the second measuring the number of political assassinations per year, per million people. Assassinations of political figures was shown to be significantly and negatively correlated with growth rates. Likewise, the number of coups and revolutions was negatively correlated with both growth of per capita GDP and investment at a significant level. An underlying theme of this research is that political instability creates market uncertainty, and therefore may reduce economic incentives to invest. However, Barro's research is careful to point out that the cause of the negative correlation may be attributed to reverse causality, and thus an economic downturn could result in higher degrees of political instability.

Ades and Chua (1997) found results similar to Barro's regarding the negative effect of instability, or exogenous shocks, on economic growth. However, Ades and Chua's research differed from Barro's as it focused primarily on possible contagion effects of regional instability. This research developed a national regional instability

index for country j as a function of the number of coups and assassinations in surrounding areas:

$$REGREV_j = \frac{1}{n} \sum_{i=1}^{n} REV_i$$

where n is the number of neighboring nations for country j, and REV is the number of revolutions and coups in bordering country i. The study found a negative relationship between economic growth and regional instability on a par with *domestic* instability, suggesting the spillover effects from exogenous political shocks can adversely influence economic growth. Intuition suggests these slower growth rates are in part determined by corresponding increases in defense expenditures, decreases in education spending, as well as disruption of trade flows. Thus, even domestically stable nations are negatively affected by political instability within the region. Although it seems intuitive that political events will negatively effect markets, the economic size of the effects are also worth noting. Ades and Chua's (1997, p. 297) research found that an increase of 1 in the average annual number of revolutions and coups in neighboring countries caused a reduction of steady state per capita income by 17.6 percent.

Other authors have reached similar conclusions regarding the negative effects of political shocks on economic performance. Alesina et al. (1996) found results similar to Ades and Chua (1997) and Barro (1991), showing negative correlations between politically destabilizing events and economic growth. Edwards (1998) claimed investors will become "skittish" in the face of political upheaval or social upheaval. He cites the 1994 assassinations of Mexican presidential candidate Luis Donald Colosio and PRI Secretary General Ruiz Massieu as a cause for the

subsequent foreign investor withdrawals from Mexico. Mishkin (2001, p. 10) suggested political uprisings have caused declines in stock markets:

> Stock market declines and increases in uncertainty were additional factors in precipitating the full-blown crisis in Mexico, Thailand and South Korea. The Mexican economy was hit by political shock in 1994 that created uncertainty, specifically the assassination of Luis Donaldo Colosio, the ruling party's presidential candidate, and an uprising in the southern state of Chiapas. By the middle of December 1994, the Bolsa (stock exchange) had fallen nearly 20 percent from its September 1994 peak.

Rodrik (1996) acknowledges political instability can translate into larger macroeconomic problems. MacIntyre (2001) further proposes that investor uncertainty, triggered by a lack of stability in the policy environment, may elicit capital flight. Wheeler and Mody (1992) find geopolitical variables, such as relations with neighboring countries and relations with the West, are positively correlated with attracting foreign direct investment.

As stated in Ades and Chua (1997, p. 1) "one of the undisputed stylized facts in the literature on the political economy of growth is the strong interconnection between economic performance and political stability." The political economy literature used in this research builds a theoretical foundation to show how both domestic and regional instability can adversely affect economies. Furthermore, the literature suggests perceived political instability causes investor uncertainty, which translates to a poorer stock market performance. This research will attempt to show whether or not the political instability generated by the Taiwan Crisis caused domestic and regional economic downturns.

Financial Economics Literature

This research incorporates two key ideas in the financial economics literature. The first states that markets are interconnected, or to some extent, dependent upon each other. This concept explains possible contagion effects between markets, as well as aiding in explaining some of the variation in stock market returns. Additionally, the paper addresses whether markets behave efficiently. The main market efficiency theory addressed in this research is the efficient market hypothesis (EMH), which addresses the degree and timeliness to which markets react to new information.

Market interconnectedness theory suggests the trend toward globalization, particularly in the form of increased foreign direct investment and trade links, causes markets to act more in unison. Stock market behaviors are one forum where this phenomenon is most clearly reflected. Lin et al. (1994) find daily daytime returns in Tokyo are correlated with overnight New York returns. This result suggests that U.S and Japanese markets are correlated, and that stock market returns in the United States in part drive returns in Japanese markets. The authors explain their result, citing many reasons why the world's largest equity markets may be interdependent. First, any news about changes in the economic fundamentals in one country likely will have an impact on the other nation because the economies are related through trade and investment. Thus "growing financial market integration will increase the degree of correlation between the stock returns of different countries by making portfolio managers in the home market more responsive to changes in foreign markets" (1994, p. 508). The authors also cite market contagion, or stock prices

being connected through economic fundamentals, as a reason for correlated stock market returns. A simple example of market contagion is the Black Monday (October 1987) stock market crash in the United States. The sharp decline in the U.S. markets led to a worldwide bear market transmission, and thus is evidence of market contagion.

King and Wadhwani (1989), using closing prices of major market indices, develop a model that tests the volatility in market returns surrounding the Black Monday stock market crash. The paper develops a "model in which 'contagion' between markets occurs as a result of attempts by rational agents to infer information from price changes in other markets" (1989, p. 1). Despite economic differences across the nations, the empirical results of their contagion model has shown volatility in one market is transmitted to others.

Eun and Shim (1989), also using daily closing prices of stock indices, provide further evidence of market co-movement by locating the main channels of transmission, and by tracing out dynamic responses of one market to changes in other markets. The paper developed a vector autoregressive (VAR) system that analyzed nine large world markets: Australia, Canada, France, Germany, Hong Kong, Japan, Switzerland, United Kingdom, and the United States. The empirical results indicate a high degree of multilateral interactions between the markets, with the United States being the most influential on returns in other world markets. Particularly relevant to the thesis of this paper is that U.S. market innovations explained about 11 percent of the variance in Japanese markets. Likewise, the U.S. markets accounted for 42 percent of market variation in Canada, and only 6.43

percent for Hong Kong. In addition to showing market interconnectedness, this result also provides evidence for "informationally efficient international stock markets" (1989, p. 243).

Efficient Market Hypothesis

Another theory from financial economics relevant to studying abnormal returns during times of exogenous shocks is the Efficient Market Hypothesis (EMH). Developed by Fama (1970), the key question the EMH tries to answer is how well markets process information, and in turn reflect the new information in stock prices. Thus, if markets are efficient, the market price of the stock is the most accurate gauge of its value. According to Reilly and Brown, "an efficient capital market is one in which security prices adjust rapidly to the arrival of new information and, therefore, the current process of securities reflect all information about the security" (2000, p. 212). The degree to which markets are efficient is traditionally broken into three tiers: weak, semistrong, and strong-form, each of which will be examined further below.

The weak-form EMH suggests markets are informationally efficient to the extent that current stock prices reflect all security market information, including historical sequence of price, rates of returns, trading volume, and all other market-generated information (2000, p. 215). In its essence, weak-form predicts that past performance is not a predictor of future returns. Therefore, since all market information already has been taken into account, stock returns are a random walk, in which security prices are driven by forces not accounted for by security-market information. Stockbrokers, and others who actively trade in the market to make

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money, assume markets are not even weak-form efficient. One phenomenon particularly relevant to international returns is the idea of "international scalping" where investors recognize international markets are interconnected, and enter positions to arbitrage this phenomenon.

Semi-strong form EMH builds upon weak-form to include all security-market information in addition to all public information. Public information includes earnings announcements, price to earning ratios, dividend yield ratios, book value-market value ratios, stock splits, economic news, and political news (2000, p. 215). Essentially, once any news is made public, markets immediately react and security prices adjust. Thus, investors cannot derive excess profits after news is made public.

The most stringent form of EMH is strong-form. Strong-form encompasses both weak and semistrong, but further asserts that stock prices fully reflect all information--public and private. This form suggests there is no insider information, and even a CEO or accountant with fundamental knowledge of a company's condition, cannot derive above-average profits from their knowledge. *"Insider Watch,"* a publication which monitors the purchases and sales of a company's stock by its officials, attempts to move markets more toward strong-form EMH efficiency (Gilchrist, 1998).

The EMH hypothesis is highly controversial, with the weak-form becoming more generally accepted, and the semistrong becoming more accepted (Pearce, p. 124). Semistrong-form EMH is most relevant to this research because it asserts markets react to public information. Political shocks caused by public announcements, as in the Taiwan Crisis, should be readily transmitted to the markets,

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adjusting the prices of securities. It is through this mechanism that we expect to find abnormal market returns.

V. CONCEPTUAL FRAMEWORK

The 1996 Taiwan Crisis represents an exogenous political shock that could have caused abnormal returns in the Japanese and Taiwanese markets. The aim of this research is to develop a mechanism that can analyze the effects of these shocks on financial variables to determine if they had a significant impact on Japan and Taiwan's markets. To meet this end, the paper's first objective is to establish a relationship between stock market index averages and a state variable with forecasting power. The model used in this paper establishes a relationship between the closing stock prices in the New York and relevant Asian markets.

After establishing a feasible relationship to forecast stock market averages using state variables, the research's second objective is to augment the model by testing for the significance of exogenous shocks. The correlation between international markets is able to explain some market variation. By adding a dummy variable to the regression at the time of the political shock, the model attempts to explain more of the market's variation in terms of stock returns. If the dummy variables, turned on at the time of the exogenous shock, prove negative and significant, it is sensible to assert that the political shock had a negative effect on financial markets. Thus the effects of the Taiwan Crisis may explain more of the variation of the examined Asian markets.

VI. METHODOLOGY

As economists frequently are asked to measure the effects of particular events on markets, a methodology has been developed specifically to address the econometric obstacles associated with studying events. Building upon assumptions of market behavior addressed in the literature review, this section outlines how and why certain obstacles are addressed in studying the impacts of the Taiwan Crisis on financial markets.

Nonsynchronous Trading

One problem relevant to comparing stock returns across international markets is correcting for inconsistent data. Often times trading days do not match up due to nonsynchronous holidays across countries. For regression analysis it is problematic that both Japan and Taiwan celebrate different holidays than the United States. For example, Japan trades on Christmas day when U.S. markets are closed. Taiwanese markets have similar holiday inconsistencies associated with national holidays. Furthermore, up until January 2001, Taiwan markets regularly traded on Saturdays, when U.S. markets have traditionally always been closed (Taiwan Stock Exchange, 10 April 2002). It is also important that both Japan and Taiwan do not have any overlapping trading hours with U.S. markets (see figure 1). The NYSE opens at 9:30AM and continues until 4:00 PM, Eastern Standard Time. The Tokyo Stock Exchange (TSE) opens at 9:00AM and trades until 3:00PM, Tokyo time. The Taiwan Stock Exchange, which is one hour ahead of Tokyo, opens at 9:00AM and finishes block trading at 3:30PM, Taipei time. Since Tokyo (Taipei) is ahead of New York by either 14 hours (15 hours) in the winter, or 13 hours (14 hours) in the

summer, the trading never overlaps in real time (Lin et al., p. 518). Thus, closing

prices in the Japan or Taiwan markets are not affected by contemporaneous trading

in the United States.
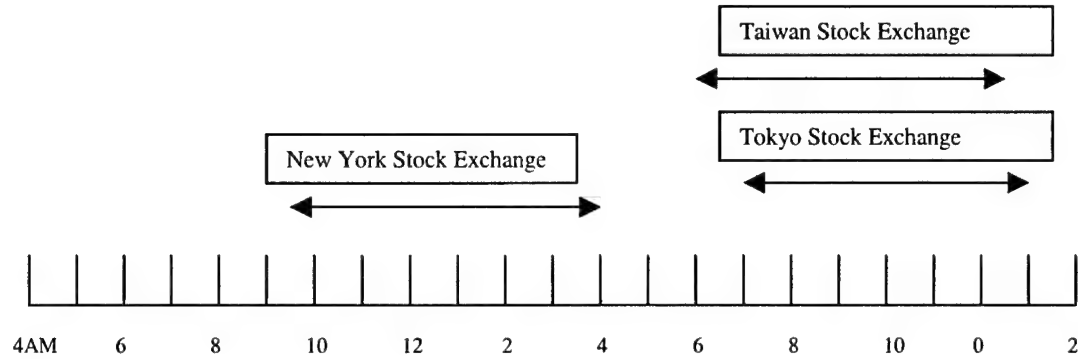
EST (Eastern Standard Time)
Figure 1
Exchange Trading Hours

To handle these data inconsistencies, this study developed a method to

account for nonsynchronous trading days across markets. First, as not to lose any

observations on the dependent variable, all trading days from Taiwan and Japan

remained in the sample, even when U.S. markets were closed. However,

observations from independent variables were deleted from the sample when foreign

markets were closed and the U.S. markets remained open. To account for days when

Japanese or Taiwanese markets were closed and U.S. markets were open, all extra

U.S. trading days were removed from the sample until the day prior to either the

Japanese or Taiwanese markets opening. Two assumptions about market behavior

help make this procedure sound. First, it is assumed that U.S. markets affect foreign

markets, and not vice versa. Therefore, no causality is lost by deleting days the U.S.

markets are open, up until one time lag before foreign markets open. Secondly, the

last day of trading in the U.S. prior to foreign markets opening represents the

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cumulative market effects to which foreign investors will react. For example, if Japanese markets were closed while U.S. markets were open, the Japanese investors would only react to the last day prior to their markets opening, and disregard any market oscillations in days prior.

A second problem relevant to handling nonsynchronous trading is how to handle data inconsistencies when U.S. markets are closed while foreign markets are open. This study assumes foreign markets react to marginal stock changes, not levels. Therefore, when U.S. markets are closed, the prior day's closing price was copied down to represent the missing trading day. This procedure is not believed to be problematic because investors are presumed to respond to marginal changes in stock prices. Therefore, copying down a prior day's closing price would represent no new market information, and thus not undermine the potential causality between U.S. markets and markets in Taiwan or Japan.

Daily versus monthly data

The frequency of data that should be incorporated when studying an event is also an important decision. The relatively easier accessibility of weekly, monthly, or quarterly data over daily data may make using longer time periods more conducive for studying events. However, when available, daily data is more optimal to use in studying certain events for a variety of reasons. Morse (1984) cites numerous reasons for using daily returns over monthly returns.

First, using more frequent data has many advantages in terms of estimating the onset of an event. An event study must correct for the existence of confounding information events that occur during the same period as the event of interest. Using

daily data significantly reduces the chance of including other major economic events that would likely be captured if using monthly returns. A second consideration of an event study is to account for the uncertainty of the magnitude of the event on security returns. Daily returns are more likely to detect the immediate magnitude effects of news announcements that may become less detectable if using monthly returns. Another reason to use daily returns is that more frequent data provides a more sensitive measure of economic impacts when there is certainty about the date of the information release. More frequent data allows the event study to be more precise in pinpointing the actual onset of the event expected to affect markets.

Morse (1984) also cites econometric advantages of using daily stock returns over monthly stock returns by generating more efficient estimates. To show the benefits of using daily data over monthly data, Morse juxtaposes two simple confounding variable models to show daily return models have a lower variance, and thus are more efficient, than models incorporating monthly returns. The two simple confounding models presented are return generating functions:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$
$$E(\varepsilon_{it}) = 0$$
$$Var(\varepsilon_{it}) = \sigma^2$$
$$Cov(\varepsilon_{it}, \varepsilon_{i,t-s}) = 0$$

(1)

where R_{it} = security return of firm i in period t;

R_{mt} = market return in period t;

α_i , β_i = parameters estimated by OLS regression; and

ϵ_{it} = residual or abnormal return not captured by the model.

For model (1) the unit of time, t, is in days. The following monthly return generating function model is aggregated by cumulating the q daily returns under the assumption daily returns are not serially correlated:

$$V_{iT} = q\alpha_i + \beta_i VT_{mT} + \eta_{iT}$$
$$E(\eta_{iT}) = 0$$
$$Var(\eta_{iT}) = \sigma^2 \qquad\qquad (2)$$
$$Cov(\eta_{iT}, \eta_{i,T-s}) = 0$$

where V_{iT} = return of firm i in month T;

V_{mT} = return of the market in month T;

q = number of trading days in a month;

α_i , β_i = parameters from equation (1); and

η_{iT} = residual or abnormal return of firm I in month T.

Additional assumptions of this model include that there are no model misspecifications and no errors in the estimated parameters. Furthermore the abnormal return, K, is considered to be constant, and other confounding information is assumed to be independent of the news announcement of interest. The variances for both monthly and daily returns are presented in Table 1.

Table 1

Variances of mean abnormal returns for monthly and daily returns

	Daily Returns (Model 1)	Monthly Returns (Model 2)
Mean abnormal return	K	K
Variance of mean abnormal return	σ^2 / n	$q\sigma^2 / n$

In this example, the additional noise from the confounding information events causes the monthly returns to have a higher variance. Thus, the lower variances associated with daily returns leads to higher t-statistics, and corresponding greater power in testing for the effects of information shocks on markets (Morse, p. 609). However, choosing between daily and monthly data becomes a moot point, from an empirical standpoint, as sample sizes become very large.

Other Event Study Concerns

Traditionally event study methodology has been applied to studying abnormal returns in financial markets regarding firm-specific or economy-wide events. The earliest known event study was Dolly (1933) which examined the price effect of stock splits. Since, event study methodology has evolved, but the seminal studies developed by Ball and Brown (1968) and Fama, Fisher, Jensen, and Roll (1969) have laid the foundation for the contemporary event study methodology (Campbell, Lo and MacKinlay, 1997). Although no concrete structure exists, Campbell et al. (1997) condense event study analysis to seven-steps:

1) Event Definition

2) Selection Criteria and estimation window

3) Normal and Abnormal Returns

4) Estimation procedure

5) Testing procedure

6) Empirical Results

7) Interpretation and Conclusions

The following section examines how each of the steps directly applies to the Taiwan Crisis.

Event Study Analysis of Taiwan Crisis

1) Event Definition

To establish an accurate event window, there are numerous questions that need to be addressed. The most salient issue is determining precise dates for which events start and finish in order to determine an accurate estimation window. Another issue is the exogeneity of the event. Was the event purely exogenous, or could information have permeated to the markets before the actual announcement? Other issues address whether there were any time-lags associated with the event, whether the event happened on a weekend or a holiday, or if there were any other major market announcements that day. For the Taiwan Crisis, the early morning announcement by the Chinese government on March 5, 1996, is recognized as the onset of the estimation window. Determining the end of the estimation window is more problematic given the numerous events that happened following the onset. However, this study recognizes March 25, the final day of missile launches, as the culmination of the event study window. The event also is assumed to be exogenous. Although Taiwan and China have had a problematic history leading up to the event, the actual announcement of live-fire exercises is assumed to have caught the markets off guard, and thus marks the onset of the estimation window. Likewise, by March 25, the situation seemed to meet a political and military equilibrium, marking the end of the window. Furthermore, no other major market news is expected to have affected the markets within this estimation window.

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2) Selection criteria and estimation window

This section addresses what data sample is most appropriate to reflect the shock. Other questions that should be addressed in selecting the data sample are whether the exogenous shock affected the aggregate market, or just certain industries, as well as how many observations are necessary to establish a pattern of normal returns. Furthermore, it should be noted whether the shock is considered permanent or temporary in nature. For the Taiwan Crisis, this study recognizes the Taiwan Weighted Index and the Nikkei 225 as the best proxies for the Taiwanese and Japanese markets, given data availability constraints. According to Hamao et al. (1990) the advantages to using the Nikkei 225 index and S&P500 index to capture the effects on the aggregate economy is that each index represents a majority of the capitalization of their respective markets. The Nikkei 225 represents 52.2 percent of the total equity capitalization from the Tokyo Stock Exchange. Likewise, the S&P500 represents 76 percent of the capitalization in the NYSE. By using these market indexes, the study is testing for aggregate market effects, but not specific industries. The sample analyzed to establish normal market returns includes approximately 120 observations as suggested by Campbell et al (1997). Also, the Taiwan Crisis is considered to be a temporary market shock, as markets recovered in the post-Crisis period.

3) Normal and abnormal returns

A crucial part of any event study is to compare market returns generated within the estimation window to normal market behavior. Normal returns are defined as the rate of market return expected as though the exogenous shock never happened. An

accurate event study must develop a sound method for predicting normal returns, as normal returns are the measuring stick to gauge abnormal returns (Calvo-Gonzalez, 2002, p. 212). This study benchmarks normal returns to a regression on U.S. market returns. Likewise, abnormal returns are any deviant market behavior that might exist during the estimation window. This model derives a test statistic to determine whether we can reject the null hypothesis that abnormal returns are zero.

4) Estimation procedure

After establishing a method for identifying normal returns, variables must be added to the model to account for differences during the estimation window. Calvo-Gonzalez (2002) distinguishes between two types of models: statistical and economic. Statistical models refer to those that identify abnormal returns using statistical means. Economic models are based upon assumptions about a firm or agent's behavior. Such models include the Capital Asset Pricing Model or Arbitrage Pricing Theory, in which parameters are constrained by fundamental assumptions about market behavior (Calvo-Gonzalez, 2002, p. 215). This paper favors statistical modeling using ordinary least squares (OLS) estimation to derive parameter estimates.

5) Testing procedure

As outlined in Morse (1984), the "Aim of the event study is to employ a statistical test that will enable us to reject (or not) with some degree of confidence, the null hypothesis that the abnormal performance of returns during the window is zero." The model presented in this research poses the null hypothesis that the dummy variable parameters, representing exogenous political shocks during the

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Taiwan Crisis is zero, and then statistically determines whether the null hypothesis can be rejected.

The "empirical results" and "interpretation and conclusions" sections of the event study methodology will be addressed in later sections of this paper.

VII. PROCEDURES: THE MODEL

The first objective of the model is to develop a credible relationship between financial variables and state variables with explanatory power. This objective is accomplished by regressing the differences in logs of the daily closing prices of the Taiwan Weighted Index and the Japanese Nikkei 225 index on one day lagged difference in logs of the closing prices of U.S. stock indexes expected to have explanatory power. The generic model is defined as:

$$TAIJAP_t = \alpha + \beta_1\left(US_{t-1}\right) + \varepsilon_t \qquad (*)$$

where $TAIJAP_t$ is the difference in logs of the closing price of either the Taiwan Weighted Index or the Nikkei 225 index at day t. The US_t variable represents differences in logs of closing prices in various U.S. stock market indexes, which are expected to explain returns in world markets. The stochastic error term, ε_t, represents any unexplained variables that drive closing stock prices in Taiwan or Japan.

After establishing a relationship between the daily closing prices of the Japanese and Taiwan indexes and the U.S. markets, the model is augmented to include a dummy variable:

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$$TAIJAP_t = \alpha + \beta_1 (US_{t-1}) + \beta_2 DUM_t + \varepsilon_t \qquad (**)$$

The dummy variable is turned on at the time of the exogenous shock to capture its effect on either Asian market.

Although the Taiwan Crisis spanned several weeks from March 5, 1996 until March 25, 1996, numerous events that happened within the estimation window are likely to have had a significant impact on financial markets. Viewing the entire crisis window as one exogenous shock, and thus only including one dummy variable for the entire estimation window, would be too blunt of a measurement of the Crisis and would fail to take into account the iterative changes that happened throughout the Crisis. Likewise, including a single dummy variable for each day of the Crisis would be too specific, and the model would run into collinearity problems. Furthermore, each of the shocks are expected to be temporary in nature. As the shocks are not viewed to be permanent, the dummy variable will only be turned on during the day of the news shock, and turned off for all other observations. Therefore, certain days within the estimation window that are expected to have the largest effects on financial markets are selected. The days expected to impact the markets most are:

1) March 5, 1996- The PRC makes a statement in the early morning that it will launch a military exercise during March 8-15, firing ground-to-ground guided missiles into waters 20 to 40 nautical miles due east of Keelung, and 30 to 50 nautical miles due West of Kaosiung. (Federation of American Scientists, 2000)

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2) March 10, 1996- The Clinton Administration's decision to dispatch

   Independence battle group from Okinawa to waters near Taiwan. (dummy

   on March 11) (Fischer and Yates, China's Missile Diplomacy, 1996)

3) March 15, 1996- United States assured China will not attack Taiwan

   (dummy for March 16) (Reuters, 1996)

4) March 18, 1996- U.S House of Representatives pass a nonbonding

   resolution calling for the United States to defend Taiwan in case of an

   invasion by China. (dummy for March 19) (Bloomberg Business News,

   1996)

The model tests the null hypothesis that abnormal returns in each of the
aforementioned days are individually zero:

$$H_0 : \delta_t = 0.$$

In each of the examined days news of the announcements are expected to propagate
swiftly through the markets. The above model is in its most general form, and will
be broken into different equations to capture the varying effects of the Taiwan Crisis
in both Taiwanese and Japanese markets.

The model is first applied to capture any abnormal returns in the Japanese
markets as related in equation (1).

$$dnikkei_t = \beta_0 + \beta_1 dlsp500_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

(1)

The aim of this model is to test the feasibility of any regional contagion effects that
possibly spread to Japanese markets. Again, given the high level of trade and
investment between Japan and Taiwan, as well as geographical proximity between

the nations, it may be plausible that Japanese investors in Taiwan became nervous over the prospect for conflict. The time lag of the U.S. S&P500 index is included as an explanatory variable to help capture any additional market variation in Japanese stock returns and assuage model misspecification. Eun and Shim (1989) found U.S. markets to explain 11 percent of Japanese market variation, and thus the U.S. markets are included in this model.

The next three forms of the general model relate to the Taiwan Crisis' effects on Taiwan's economy. Equations (2) through (4) are essentially the same except that each differs in one independent variable included to capture additional market variation caused by market contagion effects. In addition to the daily dummy variables equation two includes the lagged difference in logs of the S&P500 index to explain variation in Taiwan market returns.

$$dltaiwan_t = \beta_0 + \beta_1 dlsp500_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

(2)

The rationale for the inclusion of the S&P500 as an explanatory variable is consistent with equation (1), and works under the assumption that the world's largest equity market may in part drive returns in the Taiwanese markets.

Fundamentally equations (3) and (4) are the same. Both try to explain market variation in Taiwan by including independent variables that capture the performance of technology endowed sectors of the U.S. economy:

$$dltaiwan_t = \beta_0 + \beta_1 dlSOX_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

(3)

$$dltaiwan_t = \beta_0 + \beta_1 dlNASDAQ_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

(4)

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Equation (3) includes the difference in logs of the Philadelphia Semiconductor Index (^SOXX). The intuition for including this variable is that the Taiwan economy is heavily vested in the semiconductor industry and may be sensitive to changes in a major semiconductor index. Recognizing the substantial technology base of the Taiwanese economy, equation (4) includes the difference in logs of the NASDAQ stock index, to capture Taiwan market variation.

VIII. ECONOMETRIC TECHNIQUE

The estimation technique used for this research is standard ordinary least squares (OLS). To ensure the efficiency of the estimates obtained using OLS, many simplifying assumptions about the nature of the data are necessary. As outlined in Wooldridge (2000), the data used for this research's regressions meets both the Gauss-Markov and Classical Linear Model assumptions for OLS time-series regressions to ensure parameters have viable standard errors, t-statistics, and F-statistics. The first assumption asserts that the stochastic process is linear in parameters. The second assumption is zero conditional mean, or that for each time period, the expected value of the error term is zero. Next the model assumes no perfect collinearity such that no independent variables are a perfect linear combination of the others. Collectively these three assumptions assure that the parameter estimates are unbiased. The fourth time series assumption is that the variance of the error term is homoskedastic, or constant across time. Assumption five asserts that there exists no serial correlation, or that error terms are uncorrelated across time. The final assumption made about this model is that the error terms are

independent of the right hand side variables, and are normally distributed. All these assumptions ensure that OLS estimated parameters have desirable properties.

Depending on the amount and nature of the independent variables, a model may fall victim to the pitfall of perfect collinearity. In this model dummy variables were included to detect significant changes in the value of the Taiwanese or Japanese indexes at the time of the political shocks. Thus, the null hypothesis is that there were no abnormal returns caused by the Crisis. The dummy assumes unity during the day the political shock is first able to reach the markets, and a value of zero for all other observations. However, as numerous events within the Taiwan Crisis may have been expected to affect the markets, the model had to be selective on which days to test for abnormal returns, as not to violate the third time series assumption of no perfect collinearity.

As White tests using cross terms revealed no evidence of heteroskedasticity amongst the data (see table 3), the next assumption to satisfy is no serial correlation. Although the high degree of serial correlation typically present in time series regressions usually makes OLS not a feasible estimation technique, this paper incorporated the difference in logs method to correct for serial correlation:

$$TAIJAP_t = \log(TAI)_t - \log(TAI)_{t-1}. \tag{5}$$

The difference of logs method corrected for the model's serial correlation resulting in a weakly dependent process with a Durbin Watson statistic close to 2. Given the low likelihood of serial correlation present in the model, it was not necessary to calculate serial correlation-robust standard errors, or employ different estimation techniques such as Feasible GLS (Cochrane-Orcutt or Prais-Winsten).

IX. DESCRIPTION OF THE DATA

The data used in this research is comprised from a time-series of daily stock market closing prices in Taiwan, Japan, and U.S. markets. Approximately 120 observations, preceding and following the exogenous political shock, comprise the sample. Closing prices for the S&P500, Philadelphia Semiconductor Index (SOX), NASDAQ, and the Nikkei 225 were all obtained from Yahoo!Finance's historical archives. Daily closing prices for the Taiwan Weighted Index were obtained from the historical archives of a Bloomberg Machine. The data's descriptive statistics are outlined in Table 2.

Table 2
Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum	Obs
S&P500 Closing Price (Equation 1)	637.23	18.706	598.48	673.15	114
S&P Closing Price (Equation 2)	642.95	18.594	598.48	678.51	114
Nikkei Closing Price	20639.93	893.70	18833	22282	114
Philadelphia Semi Closing Price	191.55	13.751	165.77	215.89	114
NASDAQ Closing Price	1112.838	69.434	988.57	1248.65	114

X. RESULTS

Overall, the results suggest little empirical evidence for the Taiwan Crisis affecting either the Japanese or Taiwanese markets, and therefore could not reject the null and conclude that the Taiwan Crisis caused abnormal returns. Of all the dummies, only the March 11 dummy was marginally significant. The rest were highly insignificant and offer mixed results about expected signs. Collectively, the

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variables were jointly insignificant. A summary of parameter estimates, t statistics, as well as other significant statistics are presented in Table 3. There is little evidence for contagion effects to Japanese markets or for adverse effects on the Taiwanese markets.

Table 3
Empirical Results
(t-statistics in parenthesis)

Variable Name	EQ(1) DLNIKKEI	EQ(2) DLTAIWAN	EQ(3) DLTAIWAN	EQ(4) DLTAIWAN
INDEPENDENT VARIABLES				
CONSTANT	.001* (1.93)	0.00222* (1.668)	0.002173 (1.644)	0.002099 (1.556)
DLSPCLOSE(-1)	.3218** (2.78)	-0.0291 (-0.177)		
DLSOXCLOSE(-1)			-0.0350 (-0.645)	
DLNASDAQ(-1)				0.0604 (0.388)
DUMMY VARIABLES				
MAR5	0.00176 (0.194)	-0.0149 (-1.073)	-0.0156 (-1.127)	-0.015 (-1.085)
MAR11	-0.008948 (-0.918)	-0.0230* (-1.659)	-0.0228* (-1.651)	-0.023* (-1.644)
MAR16	0.00336 (0.374)	-0.0012 (-0.094)	0.000613 (0.0435)	-0.00165 (-0.119)
MAR19	0.00179 (0.128)	-0.000568 (-0.0410)	0.000786 (0.0564)	-0.00111 (-0.078)
OTHER DESCRIPTIVE STATS				
Durbin-Watson	2.07	1.982	1.980	1.970
R-Squared	0.104	0.0357	0.039218	0.0368
Adjusted R-Squared	0.065	-0.0098	-0.006102	-0.0086
B-G Serial Correl LM Test Prob (2-lags)	0.226	0.1651	0.213	0.1625
White Heteroskedasticity Test prob(cross terms)	0.671	0.8800	0.956	0.900
F-test(Wald, only dummies restricted)	0.2540	0.9752	0.9935	0.9645
F-Test(Wald dummies and time lags restricted)	2.659	0.7856	0.8654	0.8103
Sample Size (n)	120	112	112	112
**Sig at 1% level (two-sided test)	*Sig at 10% level (two-sided test)			

EQ1:

$$dnikkei_t = \beta_0 + \beta_1 dlsp500_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

EQ2:

$$dltaiwan_t = \beta_0 + \beta_1 dlsp500_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

EQ3:

$$dltaiwan_t = \beta_0 + \beta_1 dlSOX_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

EQ4:

$$dltaiwan_t = \beta_0 + \beta_1 dlNASDAQ_{t-1} + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$$

Contagion effects to Japanese Markets

Given the strong investment and trade links, as well as the geographic proximity between Japan and Taiwan, one might expect the Taiwan Crisis to adversely affect the Japanese economy. Positive signs are expected for the MAR16 dummy, as well as the lagged value of the S&P 500 closing price. A negative sign is expected for the MAR5 dummy. Signs for the MAR11 and MAR19 dummies are indeterminate, as U.S. involvement may be seen as either resolving or enticing conflict. Graphical analysis suggests there may have been some negative spillover effects from the Taiwan Crisis in the Japanese economy. Figure 2 highlights the daily economic activity of the Nikkei stock index surrounding March 4. Although there seems to be a negative and volatile trend throughout the crisis, and a market recovery after the Chinese halted military operations, only econometric analysis can conclude the significance of the exogenous political shock.

However, the econometric analysis provides little support that the crisis actually affected Japan. All dummies individually were statistically and economically insignificant. Furthermore, the dummies were jointly insignificant. The only significant F statistic tested the null hypothesis that all the dummies, in

addition to the time lagged U.S. market, were zero. With such small t and F statistics, discussion of economic size or expected signs becomes largely irrelevant.

There are numerous reasons why the Taiwan Crisis did not seem to affect the Japanese economy. The most prominent explanation for a lack of effect is that the Japanese economy is too robust to feel the effects of the Crisis. For example, in addition to being the world's second largest equity market, the Japanese economy has been in recession throughout the 1990's, and has fallen victim to numerous banking and governmental problems. From this standpoint, Japan has too many other factors driving returns, to react to this overseas political shock.

However, equation (1) does provide some evidence for contagion effects across international borders. The parameter on the lagged closing price of the S&P500 is significant at the 1 percent level. It is also economically large, suggesting that a 1 percent change in the U.S. markets results in a 0.322 percent change in the Japanese markets. Furthermore, the R squared value for equation (1) is 0.104. This result is largely consistent with Eun and Shim's (1989) finding that U.S. markets explain 11 percent of the variation in Japanese markets.
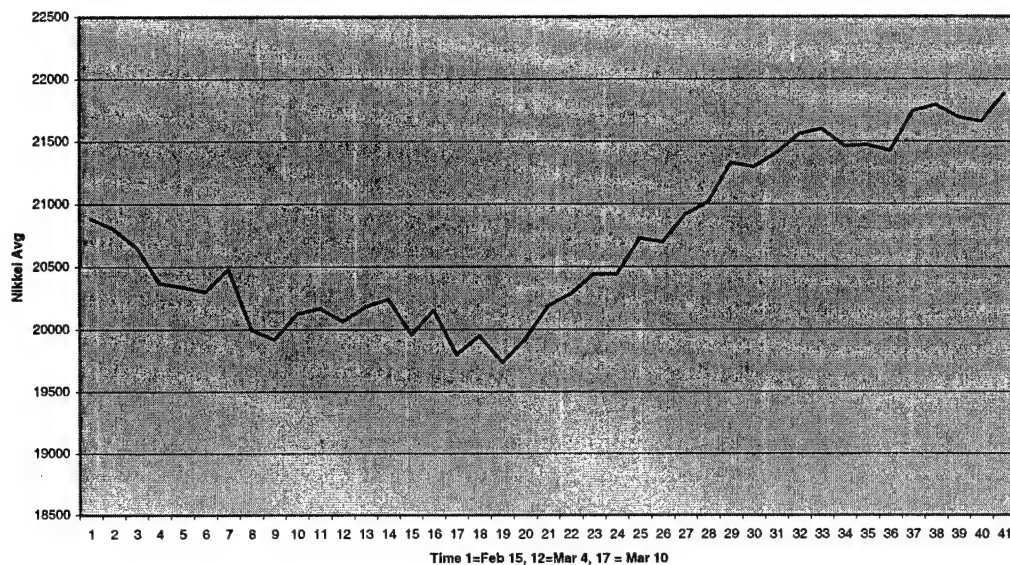
Figure 2
Nikkei Daily Average (Feb 15-April 15, 1996)

Effects on the Taiwanese Economy

Contrary to the Japanese markets, the U.S. markets are not able to explain

much of the variance in Taiwanese Stock returns. Neither the S&P500, the

Philadelphia Semiconductor Index, or the NASDAQ had much explanatory power in

determining returns in the Taiwanese markets. In fact in equations (2)-(4), the R

squared values were barely positive, and the adjusted R squared values were actually

negative. Therefore, there is little evidence for contagion effects from the U.S. to

Taiwanese markets. Although this model finds little evidence for market contagion,

it is roughly consistent with Eun and Shim's (1989) result that the U.S. market

explained only 6.43 percent of the variation in Hong Kong--if the Hong Kong market

is considered roughly equivalent to Taiwan. It seems that the U.S. market has even a

smaller effect on Taiwanese returns.

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As for the actual effect of the Taiwan Crisis on Taiwan, this model finds surprisingly little evidence of abnormal returns. All of the independent variables in equation (2), (3), and (4) were statistically insignificant. Although the MAR5 dummy had no significant t statistics, all the signs were negative as expected. Similarly the MAR11 dummy, representing the United States announcement of additional military presence, had no highly significant t statistics, but a much greater significance level than the other days examined with t statistics around -1.65. Intuitively, the expected sign of this dummy is indeterminate because the Taiwan markets may see the U.S. presence as discouraging conflict, while others may see the presence as heightening the probability of an accident. All coefficients in equations (2)-(4) were negative. With negative and marginally significant parameter estimates, this result provides weak evidence that markets reacted negatively to the announcement of the Clinton Administration's decision to dispatch a carrier battle group to the area. The MAR16 dummies were all insignificant with conflicting signs. An announcement assuring that China would not attack Taiwan is expected to react favorably in the markets. However, the low significance level of these variables makes it difficult to speculate at the reasons for conflicting size and signs. The MAR18 dummies, were all negative but insignificant, suggesting no impact of the U.S. announcement to defend Taiwan on financial markets. Graphically, the months surrounding the Taiwan Crisis display little excess volatility, as displayed in figure 3.
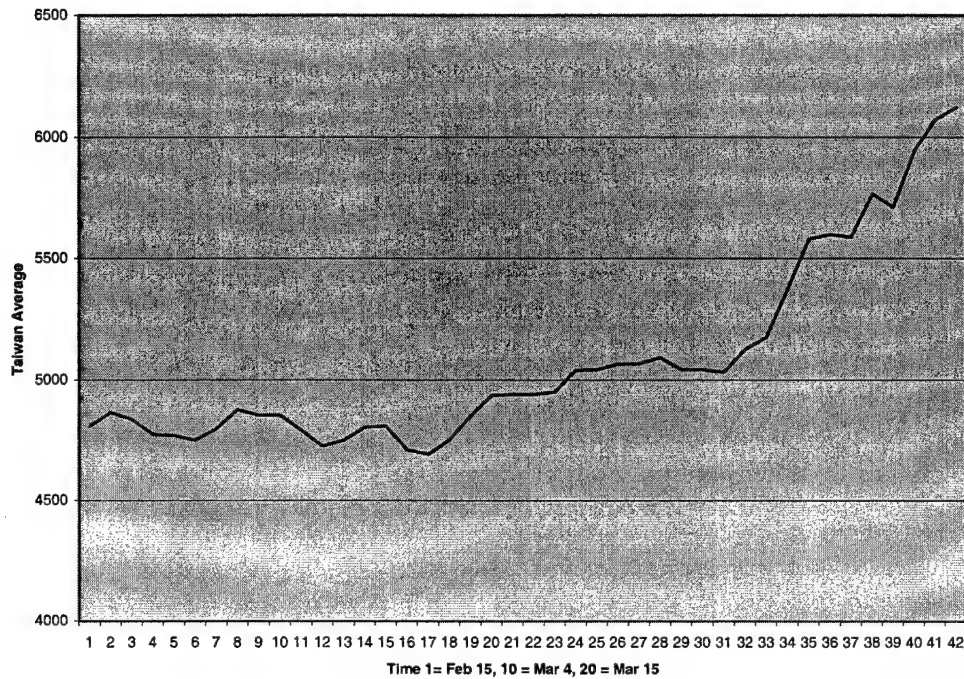
Figure 3
Taiwan Weighted Index Daily Average (Feb 15-April 15 1996)

Collectively the variables were jointly insignificant. The first scenario tested the null hypothesis that jointly the parameter estimates for all the dummies were equal to zero. The second scenario tested the joint null hypothesis that the dummies, in addition to the U.S. market proxy variables, were equal to zero. The F statistics for equations (2)-(4) were all highly insignificant and presented in Table 3.

As the U.S. markets had little effect on influencing the Taiwanese markets, the U.S. market proxy variable was removed as presented in equation (5) below.

EQ5: $dltaiwan_t = \beta_0 + \delta_1 MAR5 + \delta_2 MAR11 + \delta_3 MAR16 + \delta_4 MAR19 + u_t$

The proxy variable was removed to test whether the inclusion of an insignificant variable in anyway affected the parameter estimates of the dummy variables. The results of this regression are largely similar to the regressions that included a U.S.

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market variable. Still the t and F statistics were economically small and statistically

insignificant. The results are presented in Table 4.

Table 4
Empirical Results (no U.S. proxy variable)
(t-statistics in parenthesis)

| Variable | EQ(5) | |
Name	DLTAIWAN	
INDEPENDENT VARIABLES		
CONSTANT	.002	
	(1.049)	
DUMMY VARIABLES		
MAR5	-0.01448	
	(-0.944)	
MAR11	-0.022139	
	(-1.443)	
MAR16	-0.000616	
	(-0.040127	
MAR19	0.000265	
	(0.01725)	
OTHER DESCRIPTIVE STATS		
Durbin-Watson	1.825	
R-Squared	0.0266	
Adjusted R-Squared	-0.0094	
B-G Serial Correl LM Test Prob (2-lags)	0.6177	
White Heteroskedasticity Test prob(cross terms)	0.9593	
F-Test(Wald, dummies restricted)	0.737997	
Sample Size (n)	112	

A lack of economically or statistically significant results of the Taiwan Crisis

affecting the Taiwan markets could be speculated from many angles. One reason for

the lack of statistical significance may be explained by poor econometric

assumptions made by the model. Given the relatively low R squared values in all

four equations, there is a chance that the model was misspecified, and did not control

for other contemporaneous market information. However, if stock returns are truly

random in nature, explaining any amount of variation is rare. Therefore it would be difficult to misspecify the model.

Assuming that the model was correctly specified, there are myriad other reasons that explain why this political shock did not cause abnormal returns in either the Japanese or Taiwanese markets. As previously explained, the markets may be too robust and diverse to react to this political shock. This notion is more palatable for the large Japanese market, but offers a less convincing explanation for the smaller Taiwanese market.

Another reason for the lack of abnormal returns in Taiwanese markets is that the markets already have discounted Chinese militarization into the stock prices. As highlighted in the Historical Overview section this research, China and Taiwan have had a long and unstable relationship since 1949. Therefore, this event may have been regarded as China's typical "sabre-rattling" (The Economist, 2002). Given the historically hostile relationship between China and Taiwan, and in particular the 1995 missile tests, it seems possible that world viewed China's threats with little credibility. China's military actions were already priced into the stock prices, and the financial markets did not view the Taiwan Crisis as "excess conflict." In a sense China's repeated threats to attack Taiwan created a "little boy crying wolf effect" where the Taiwanese and Japanese markets seem to call the PRC's military bluff, by not reacting to this threat. This concept of discounting past information into security prices is consistent with the weak form efficient market hypothesis (EMH).

Another possible reason for the Taiwan Crisis to have little affect on Taiwan's economy is that the Taiwan markets are consistently volatile. Because

Taiwan's economy is relatively specialized in few goods and services, particularly within the technology sector, it is highly susceptible to demand changes. Thus, as the Taiwanese market has proven to be volatile, the market fluctuations during the Crisis may be regarded as no more volatile than normal.

Tests for Excess Volatility

Although little evidence was found suggesting abnormal market returns during the Taiwan Crisis, there are alternative ways to test for abnormal market performance during the Crisis. This section tests for abnormal behavior by running secondary tests to check for any excess volatility during the Crisis using ARCH (Autoregressive Conditional Heteroskedasticity) modeling techniques. ARCH and GARCH (generalized ARCH) models are used in this research to test for any excess variance, or volatility, at the time of Taiwan Crisis. ARCH modeling tests the volatility by modeling both the conditional mean and conditional variance of the sample data. Although there are numerous ARCH and GARCH specifications, the technique used in this paper is the commonly used GARCH(1,1) specification. The (1,1) refers to the presence of a first order GARCH term (the first term in parentheses) and a first order ARCH term (the second term in parentheses).

According to prior results, the two dates most likely to have caused abnormal returns were March 5 and 11 (although neither dates proved to highly statistically significant). This section further examines these dates to test for excess volatility. In order to allow the Taiwan Crisis phenomenon the greatest opportunity to present itself as the cause of excess volatility in either the Japanese or Taiwanese markets, several variations of the GARCH(1,1) model were executed. The model was run in

four different ways, each differing in the way the conditional mean equation and the mean variance equation were specified. Specification(1) included only an intercept in both the mean and variance equations. Specification(2) included the full set of explanatory variables in the mean equation, but only an intercept in the variance equation. Specification(3) only used an intercept in the mean equation, but used a full set of variables in the variance equation. Specification(4) used full sets of variables in both mean and variance equations. The results for excess volatility in Japan (Table 5) and Taiwan (Table 6) are presented below.

Table 5
Japan Market Volatility Results
GARCH(1,1) Model
(p values in parenthesis)

	Specification(1)	Specification(2)	Specification(3)	Specification(4)
CONDTIONAL MEAN EQUATION				
CONSTANT	0.0013	0.0011	0.001535	0.00119
	(0.102)	(0.200)	(0.0889)	(0.3326)
DLSPCLOSE(-1)		0.313**		0.324745*
		(0.002)		(0.0371)
MAR5		0.0018		0.00170
		(.999)		(0.9981)
MAR11		-0.0097		-0.008895
		(0.9691)		(0.9195)
CONDITIONAL VARIANCE EQUATION				
CONSTANT	0.000**	0.000	0.000	0.000
	(0.0002)	(0.3048)	(0.1926)	(0.487)
ARCH(1)	-0.0699**	-0.0691	-0.0679**	0.1450
	(0.0022)	(0.272)	(0.000)	(0.5121)
GARCH(1)	0.6156**	0.622	0.5802	0.5998
	(0.000)	(0.119)	(0.1065)	(0.2653)
DLSPCLOSE(-1)			0.00062	0.0004
			(0.4258)	(0.8558)
MAR5			0.000	-0.0001
			(0.6248)	(0.6284)
MAR11			0.0002	-0.00009
			(0.694)	(0.6576)
OTHER DESCRIPTIVE STATS				
Durbin-Watson	2.097	2.0586	2.093	2.059
R-Squared	0.000	0.103	-0.001	0.1029
Adjusted R-Squared	-0.0256	0.0554	-0.054	0.0295
Sample Size (n)	121	120	120	120
**Sig at 1% level (two-sided test)	*Sig at 5% level (two-sided test)			

Table 6
Taiwan Market Volatility Results
GARCH(1,1) Model
(p values in parenthesis)

	Specification(1)	Specification(2)	Specification(3)	Specification(4)
CONDTIONAL MEAN EQUATION				
CONSTANT	0.0010	0.0014	0.0012	0.0015
	(0.4712)	(0.297)	(0.3844)	(0.5017)
MAR5		-0.0140		-0.0145
		(.9603)		(0.9982)
MAR11		-0.0225		-0.0221
		(0.9412)		(0.9987)
CONDITIONAL VARIANCE EQUATION				
CONSTANT	0.000	0.000	0.000*	0.000
	(0.0662)	(0.0659)	(0.0467)	(0.2432)
ARCH(1)	0.1730	0.1668	0.1974	0.1494
	(0.1741)	(0.1506)	(0.157)	(0.4194)
GARCH(1)	0.5118*	0.5538**	0.4704*	0.5986
	(0.0279)	(0.0092)	(0.0385)	(0.0586)
MAR5			0.000	-0.0002
			(0.9691)	(0.4350)
MAR11			0.0002	-0.000217
			(0.8376)	(0.7334)
OTHER DESCRIPTIVE STATS				
Durbin-Watson	1.801	2.0586	1.801	1.8257
R-Squared	-0.0002	0.103	0.000	0.0266
Adjusted R-Squared	-0.02772	0.0554	-0.0467	-0.0383
Sample Size (n)	113	113	113	113
**Sig at 1% level (two-sided test)	*Sig at 5% level (two-sided test)			

A significant GARCH or ARCH term in the variance equation implies that the sample follows a persistent clustered volatility process. More simply put, once there is a shock to the stock market, the shock is more likely to persist in the days following. Similarly, an insignificant ARCH or GARCH implies that a shock only would last for one period. Likewise, a significant dummy variable in the variance equation implies that those specific days significantly impacted the samples variance, or volatility. Therefore, a significant dummy variable would be evidence for excess market volatility caused by the political shock.

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For the Japan regressions, specifications (1) and (3) have significant ARCH terms, while only specification (1) has a significant GARCH term. These significant terms suggest that within this sample there exists evidence for clustered volatility surrounding a shock. However, the March 5 and March 11 dummies show no signs of significantly affecting the sample variance, or volatility, in the days examined. Overall, Japanese markets do not show strong evidence of excess volatility during the sample period--particularly on March 5 and March 11.

For the Taiwan regression's GARCH(1) terms, specification (2) was significant at the 1% level, specifications (1) and (3) at the 5% level, and specification (4) at the 6% level. These results suggest shocks to Taiwan's economy in this sample were persistent in nature and market volatility took several days to resume normality. Contrary to the Japanese market's volatility, none of the ARCH(1) terms were significant. Furthermore, the insignificant p values for the dummy variables imply that neither March 5 or March 11 caused any excess volatility in the Taiwanese markets. These results suggest the onset of the Taiwan Crisis, as well as the Clinton Administration's decision to dispatch a carrier battle group caused the Taiwanese markets to be no more volatile than normal.

Graphical analysis provides another way of checking for excess volatility at the time of the Taiwan Crisis. As Japan seemed to experience little abnormal market behavior during the Crisis, the following graphical analysis is reserved solely for the Taiwanese markets. Figures (4)-(7) graph the GARCH terms throughout the sample period for each of the specifications outlined in Table 6. The March 5 and March 11 dummies correspond to data points 47 and 51 respectively.
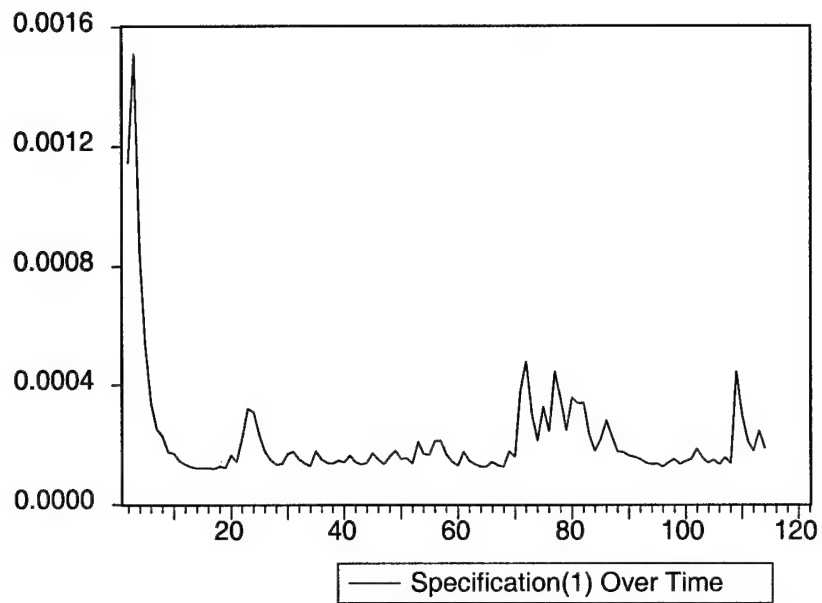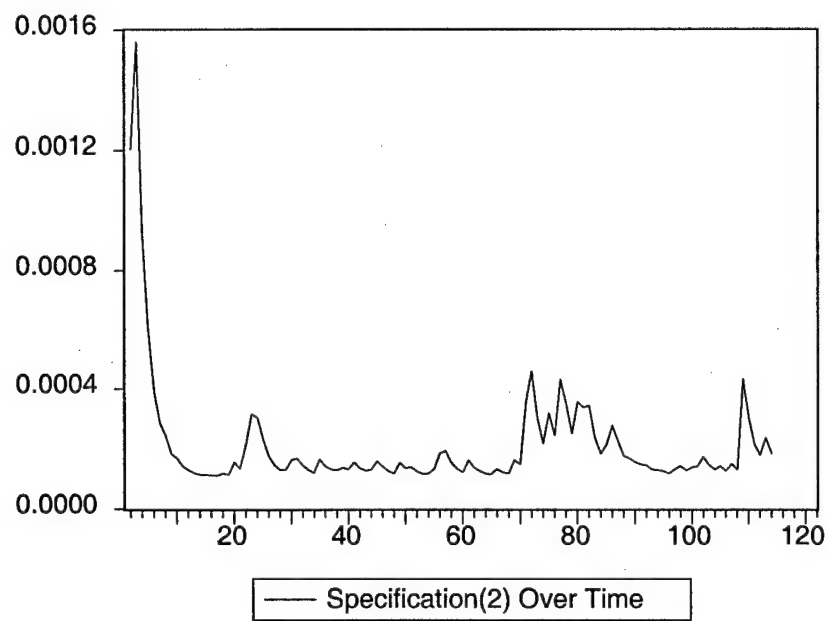
44

Figure 4
Specification(1) Over Time

Figure 5
Specification(2) Over Time
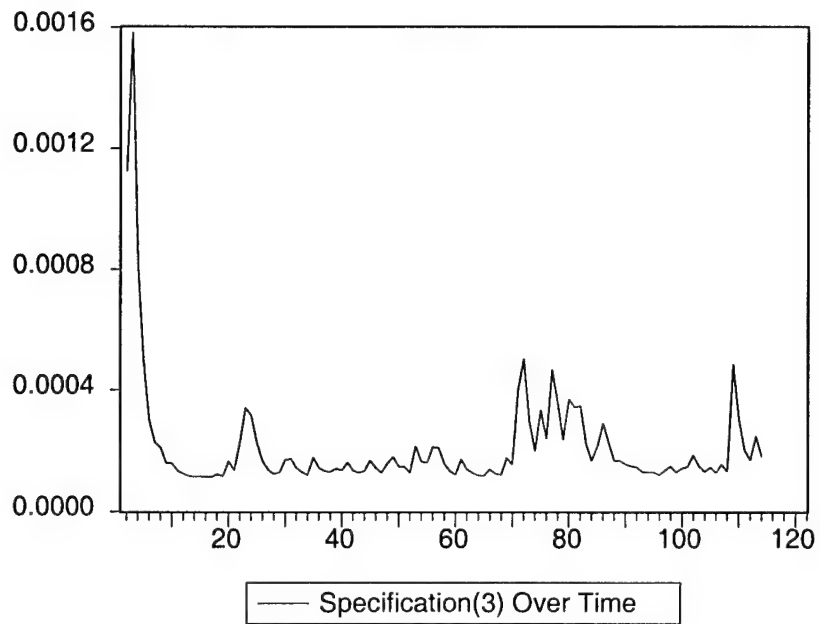
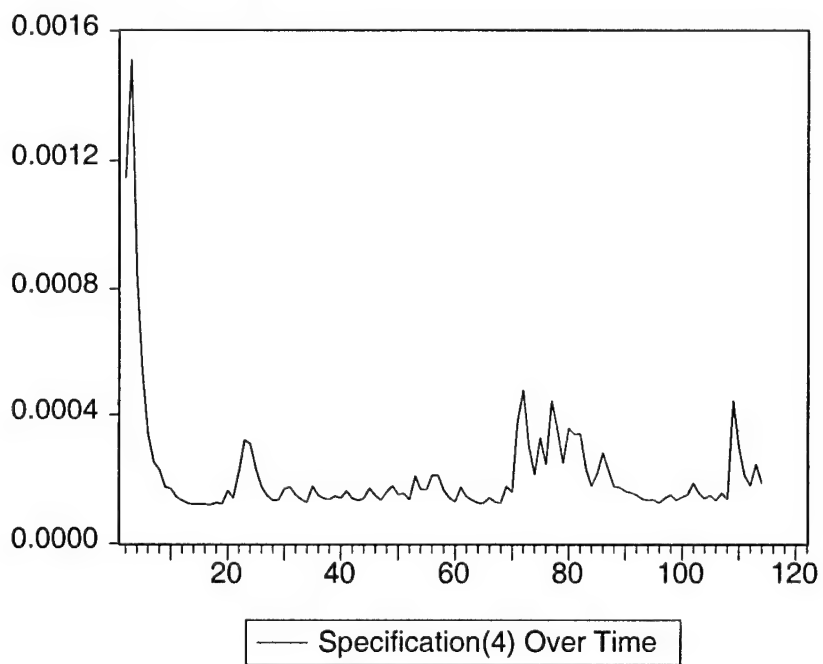45

Figure 6
Specication(3) Over Time

Figure 7
Specification(4) Over Time

Graphically, over the sample these points seem to demonstrate little excess volatility. In fact, throughout the entire Taiwan Crisis estimation window (data points 47-64) there seems to be little excess volatility. The sample period's most volatile trading days happen entirely outside of the Taiwan Crisis' estimation window. Therefore, it seems that both empirically and graphically, there is little evidence of excess volatility in Taiwanese markets during the Crisis.

What could possibly explain the lack of abnormal volatility in Taiwan markets during the Crisis? It seems reasonable that Japanese markets did not experience excess volatility for the same reasons it did not experience abnormal returns. However, one might expect more of a reaction in the Taiwanese markets due to the proximity of the Crisis to Taiwan. Perhaps the lack of evidence for excess volatility in the Taiwanese markets is rooted in the nature of the Taiwanese economy. Relative to major world economies such as the United States and Japan, Taiwan's economy is not very diversified. Its economy is heavily invested in computers, semiconductors, and plastics, and therefore its stock market is subject to severe volatility as the demand for these products fluctuates. It is possible that the Taiwan Crisis may have caused the Taiwanese markets to react. But these reactions go undetected as they pale in comparison to normal volatile nature of the Taiwanese economy.

XI. CONCLUSIONS AND MODEL EXTENSIONS

Overall, this model suggests that the Taiwan Crisis of 1996 had little effect on the financial markets in Japan or Taiwan. This is an interesting result for many reasons--economically and politically. If the Taiwan Crisis really had little effect on

financial markets it implies that the media's doomsday prediction of economic downturn is incorrect. In this light, Bloomberg Business News' assertion that, "Investors also responded to passage yesterday by the U.S. House of Representative of a nonbinding resolution calling for the U.S. to defend Taiwan in case of an invasion by China," seem to have little credibility (1996). It seems that the markets had already priced in China's intimidation tactics, and this Crisis was not viewed in excess of the status quo. This model finds little significance that Taiwanese markets reacted to this event, or caused contagion in Japan. The press seemed to perpetuate a "war fever" never actualized in financial markets.

Politically, the results of this research have implications. In a way it uncovers the ambivalence in the Asian region toward actual conflict between China and Taiwan. Citizens of the region seem to trust the current safeguards in place to prevent conflict, and thus markets do not drastically react to China's flexing of military might. It may be reassuring for governments to know that their citizens, or at least financial markets, do not believe armed conflict between Taiwan and China is likely.

This event study provided one way to analyze the Taiwan Crisis. Another angle that may shed light on effects of the Taiwan Crisis is to compare industry or firm returns of Japanese and Taiwanese companies to overall market returns. Perhaps the Crisis did not affect the aggregate economy, but could have had a significant impact on specific companies or industries. For example, one might expect the Crisis to have a positive effect on Taiwan's defense industry, but a negative effect on its tourism industry. Another way to check for effects of the

Taiwan Crisis on financial markets is to develop a general equilibrium model that takes into account several countries and factors. Certainly exchange rates, trade links, FDI, geographical proximity, and numerous other factors all contribute to market returns.

Event studies are powerful tools to analyze the effects of exogenous shocks on financial markets. This research examines how the Taiwan Crisis political shock may have affected financial markets. However, the model could easily be extended to study other exogenous political shocks. Provided the proper data is available, this methodology could be extended to study the economic impacts of numerous other political shocks. Past events such as East Timor civil unrest, the Gulf War, or even the September 11 terrorist attacks could be studied in a similar manner to determine their impacts on relevant financial markets. More importantly, the same methodology could be applied as the world continues to experience crises into the future.

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DATA SOURCES

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